21. Local max at $(-2, 17)$; local min at $\left(\frac{4}{3}, -\frac{41}{27}\right)$

23. Min value 0 at $x = -1, 1$

25. Min value 1 at $x = 0$

27. Max value 2 at $x = 1$; min value 0 at $x = -1, 3$

29. Maximum value is $\frac{1}{2}$ at $x = 1$;

minimum value is $-\frac{1}{2}$ at $x = -1$.

31. Maximum value is 11 at $x = 5$;
minimum value is 5 on the interval $[-3, 2]$;
local maximum at $(-5, 9)$

33. Maximum value is 5 on the interval $[3, \infty)$;
minimum value is -5 on the interval $(-\infty, -2]$.

35.

crit. pt.	derivative	extremum	value
$x = -\frac{4}{5}$	0	local max	$\frac{12}{25}10^{1/3}$
$x = 0$	undefined	local min	0

$(0, 0)$ is not a stationary point.

37.

crit. pt.	derivative	extremum	value
$x = -2$	undefined	local max	0
$x = -\sqrt{2}$	0	minimum	-2
$x = \sqrt{2}$	0	maximum	2
$x = 2$	undefined	local min	0

$(-2, 0)$ and $(2, 0)$ are not stationary points.

39.

crit. pt.	derivative	extremum	value
$x = 1$	undefined	minimum	2

$(1, 2)$ is not a stationary point.

41.

crit. pt.	derivative	extremum	value
$x = -1$	0	maximum	5
$x = 1$	undefined	local min	1
$x = 3$	0	maximum	5

$(1, 1)$ is not a stationary point.

43. (a) Max value is 144 at $x = 2$. (b) The largest volume of the box is 14
cubic units and it occurs when $x = 2$.

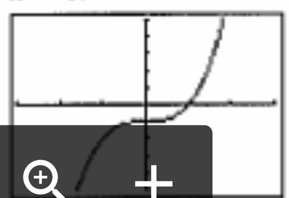
45. False. For example, the maximum could occur at a corner, where $f'(c)$
would not exist.

47. E **49.** B

51. (a) No
(b) The derivative is defined and nonzero for $x \neq 2$. Also, $f(2) = 0$, an
$f(x) > 0$ for all $x \neq 2$.
(c) No, because $(-\infty, \infty)$ is not a closed interval.
(d) The answers are the same as (a) and (b) with 2 replaced by a.

53. (a) $f'(x) = 3ax^2 + 2bx + c$ is a quadratic, so it
can have 0, 1, or 2 zeros, which would be the
critical points of f. Examples:

The function $f(x) = x^3 - 3x$ has two critical points at $x = -1$ and
$x = 1$.



$[-3, 3]$ by $[-5, 5]$